Gas Supersaturation Monitoring Report for Spill Below Bonneville Dam March 2-6 and March 11-15, 2004

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Introduction

To aid the downstream survival of about 7.5 million tule fall chinook juveniles scheduled for release from the Spring Creek National Fish Hatchery on March 11, 2004, the U.S. Fish and Wildlife Service (Service) began discussions with the Action Agencies (Bonneville Power Administration (BPA), and U.S. Army Corps of Engineers (Corps)) in October 2003 to request the provision of spill during the March release. Negotiations followed with the result being a test of the new Bonneville Dam corner collector (B2CC) versus traditional spill for passing the March 2004 release of Spring Creek NFH sub-yearling tule fall chinook juveniles. The operation agreed upon was for a period of 96 hours of spill following the release of half the March group, with a second 96 hour period of B2CC operation several days later for the remaining half of the March release group. Sufficient depth for total dissolved gas (TDG) compensation over listed chum redds below the Bonneville project was requested. It was calculated by biologists with the USFWS that the requested level of flow and spill would produce a maximum TDG level not exceeding 120% in the tailrace of Bonneville Dam and a maximum TDG level not exceeding 105% above the chum and fall chinook salmon redds below Bonneville Dam at the Ives Island complex and across the river along the Oregon shore (Figure 1).

The USFWS requested a TDG waiver from the Oregon Department of Environmental Quality (ODEQ) and an adjusted dissolved gas standard from the Washington Department of Ecology (WDOE) for spill at Bonneville Dam for a ten day period in March, 2004. These requests were made to allow for TDG saturation up to 115% as measured at the Camas/Washougal monitoring station (RM 122) and 120% in the Bonneville Dam tailrace, as measured at the Warrendale monitoring stations (RM 140) on the Washington and Oregon shores, respectively. The Oregon Environmental Quality Commission approved this request at its February 6, 2004 meeting. The Oregon waiver was a multi-year waiver for spill in March through 2007. The WDOE provided the adjusted TDG standard on February 27, 2004. The Washington adjusted TDG standard expires on February 27, 2005. One of the conditions of the approved waiver and adjusted TDG standard was that the USFWS conduct biological and physical monitoring downstream of Bonneville Dam during the spill period and to provide reports of this monitoring. This report summarizes the results of this monitoring program.

Operations

The Salmon Managers requested that the Bonneville Dam Second Powerhouse (PH2) have first use priority for power generation during the spill period. It has been demonstrated in previous years that greater use of the second powerhouse would direct water with lower TDG levels along the Washington side of the river where most of the salmon redds were located. A maximum level of 105 % TDG (factored for depth

compensation) over the chum reads in the Ives Island complex, and the expected highest elevation (11.3 foot tailwater) chum salmon redds on the Oregon shore, would be maintained.

Spring Creek National Fish Hatchery, located along the Columbia River at RM 167.2, released 3.7 million tule fall chinook salmon in the early afternoon of March 1. Spill began at Bonneville Dam starting at 2000 hours on March 2, with a spill level target of 50 kcfs. Spill was terminated at 2000 hours on March 6.

The second release took place on March 10 in the morning. Approximately 3.7 million sub-yearling fish were released. The B2CC began operation began in the afternoon of March 11 and continued for 96 hours, until the afternoon of March 15. The B2CC flow was about 5-6 Kcfs.

The USFWS Columbia River Fisheries Program Office (CRFPO) monitored water conditions and examined fish collected below Bonneville Dam for signs of gas bubble trauma (GBT) during the March 2004 spill and B2CC operations.

The number of juvenile fish observed passing Bonneville Dam at the juvenile fish facility during and after the spill and B2CC operations are detailed in Table 1 and Figure 2.

Biological Monitoring

The biological monitoring program included collecting at least 100 fish (juvenile salmonids and resident fish) during the period of spill and B2CC operations examining for signs of GBT. Sampling was conducted on March 3. Personnel from the USFWS who examined fish for signs of GBT had been trained on examination techniques by staff from the Fish Passage Center who administer the mainstem Columbia River gas bubble trauma sampling program for the Fish Passage Program, and provide the annual report to the Corps.

Washington Department of Fish and Wildlife (WDFW) and Oregon Department of Fish and Wildlife (ODFW) personnel using a 100-foot-long beach seine sampled in near shore areas of the Columbia River and Ives Island (RM 142.5, approximately) side channels at sampling sites that they continuously monitor for emerging and stranded fry. Figure 3 displays the locations of WDFW/ODFW beach seining sites where fish were collected. USFWS biologists used dissection microscopes to examine captured fish for signs of GBT. A minimum of 10x magnification was used for viewing fins. Protocol for GBT exams in 2004 mirrored the protocol used in 2002. The same ranking system was used to rank the caudal fin (tail) and the unpaired fins. This has been shown to be best indicator of prevalence of GBD at all TDG levels tested, and fins show the progressive change in severity of GBD.

Results:

A total of 112 fish were examined for signs of GBT (Table 2). No fish showed signs of GBT.

Monitoring of Physical Conditions

The USFWS monitored tailawter depth and TDG data from the tailrace monitor (Warrendale) and the downstream (Camas/Washougal) monitor. These data were collected and transmitted automatically for display on the Corps website (www.nwd-wc.usace.army.mil/report/total.html).

Results:

Figure 4 shows total discharge and spill at Bonneville Dam before, during, and after the spill and B2CC operations. Total discharge varied from 111-188 Kcfs. Spill volume ranged from 43-51 Kcfs during the spill period.

Figure 5 visually compares the TDG readings taken at the Bonneville Dam forebay and the sampling stations downstream of Bonneville Dam from March 11 through March 18 (before, during, and after the spill and B2CC operations). Ambient TDG levels ranged from 100.9-104.4 % in the Bonneville forebay. None of the downstream readings went above 107.5% during this time period. Recorded TDG levels at the Warrendale monitoring station varied from 101.7% to 107.2% during this time period. The TDG levels recorded at the Camas/Washougal monitoring station varied from 101.7 to 107.5%

Table 3 displays the tailwater depths and the TDG levels from the tailrace and downstream monitoring sites during the specific spill and B2CC operations. Tailwater elevations varied from 12.5-14.9 feet, and averaged 13.7 feet during the spill period. During the B2CC operation the tailwater elevations varied from 12-15.4 feet, averaging 12.8 feet. During these time periods the depth over the chum redds (elevation 11.3 feet) varied from 0.7 feet to 4.1 feet. Compensation for relative TDG is provided by depth at a rate of about 10% per meter. TDG levels never reached 105% at the chum redds along the Oregon shore.

Summary

The USFWS collected and examined fish for signs of gas bubble trauma, and monitored water quality in the mainstem Columbia during the March 2 to 6 spill period and monitored water quality during the March 11-15 B2CC operation at Bonneville Dam. Biological sampling was conducted on March 3. Biological monitoring showed that none of the 112 fish that were collected and examined exhibited any indication of gas bubble trauma.

Total dissolved gas levels recorded at the tailrace monitoring station (Warrendale) did not exceed the 120% waiver limit (107.2% actual). The TDG levels recorded at the Camas/Washougal monitoring station did not exceed the 115% waiver limit (107.5% actual).

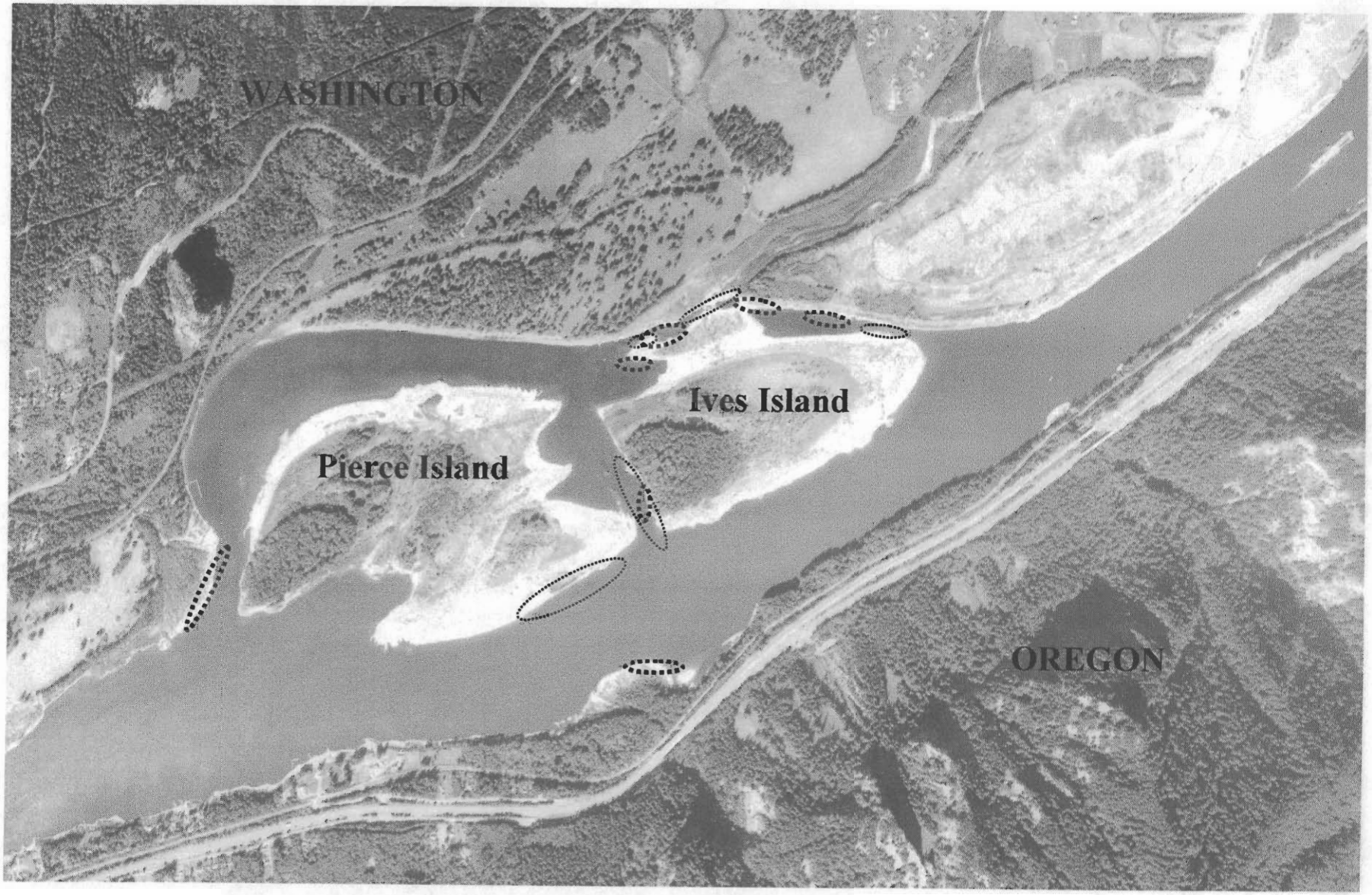

Figure 1. Location of salmon redds in the Ives/Pierce area below Bonneville Dam through December 15, 2003 surveys.
chinook chum

Table 1. Fish passage index counts at Bonneville Dam (2000-04), combined subyearling chinook. Index counts are from Power House 2 beginning in year 2000. In all previous years index counts were from Power House 1.

Number of days into spill start	Spring Creek Release "B" 03/01/04 Index Count	B2CC Date	Spring Creek Release "A" 03/01/04 Index Count	Spill Date	Spring Creek Release 03/01/03 Index Count	Spill Date	Spring Creek Release 03/11/02 Index Count	Spill Date	Spring Creek Release 03/08/01 Index Count	Spill Date	Spring Creek Release 03/09/00 Index Count	Spill Date
-1		03/10/04	-----	03/01/04	-----	03/09/03	-----	03/11/02	-----	03/09/01	47	03/08/00
1		***03/11/04***	-----	***03/02/04***	-----	***03/10/03***	847	***03/12/02***	-----	***03/10/01***	139	***03/09/00***
2	50,260	03/12/04	20,825	03/03/04	256,056	03/11/03	17,434	03/13/02	-----	03/11/01	1,228	03/10/00
3	242,411	03/13/04	173,388	03/04/04	62,621	***03/12/03***	367,558	03/14/02	-----	03/12/01	516,102	03/11/00
4	52,319	03/14/04	123,449	03/05/04	16,830	03/13/03	187,981	***03/15/02***	59,454	***03/13/01***	1,104,556	03/12/00
5	18,647	***03/15/04***	26,718	***03/06/04***	5,861	03/14/03	158,610	03/16/02	31,679	03/14/01	47,187	03/13/00
6	7,230	03/16/04	4,464	03/07/04	940	03/15/03	11,607	03/17/02	18,041	03/15/01	22,308	03/14/00
7	7,322	03/17/04	6,740	03/08/04	1,148	03/16/03	5,645	03/18/02	5,075	03/16/01	7,019	03/15/00
8	4,644	03/18/04	3,678	03/09/04	708	03/17/03	3,718	03/19/02	4,760	03/17/01	7,286	***03/16/00***
9	3,829	03/19/04	2,331	03/10/04	576	03/18/03	1,672	03/20/02	3,024	03/18/01	3,236	03/17/00
10	6,186	03/20/04	2,310	03/11/04	745	03/19/03	2,624	03/21/02	2,531	03/19/01	2,275	03/18/00
11	5,976	03/21/04			386	03/20/03	756	03/22/02	4,782	03/20/01	2,108	03/19/00
12 Day Total	398,824		363,903		345,871		758,452		129,346		1,713,491	
5 Day Passage	363,637		344,380		341,368		732,430		91,133		1,669,212	
5 Day %	91.2%		94.6%		98.7%		96.6%		70.5%		97.4%	

----- no counts taken, no data available

bolded dates are first and last days of spill or Corner Collector

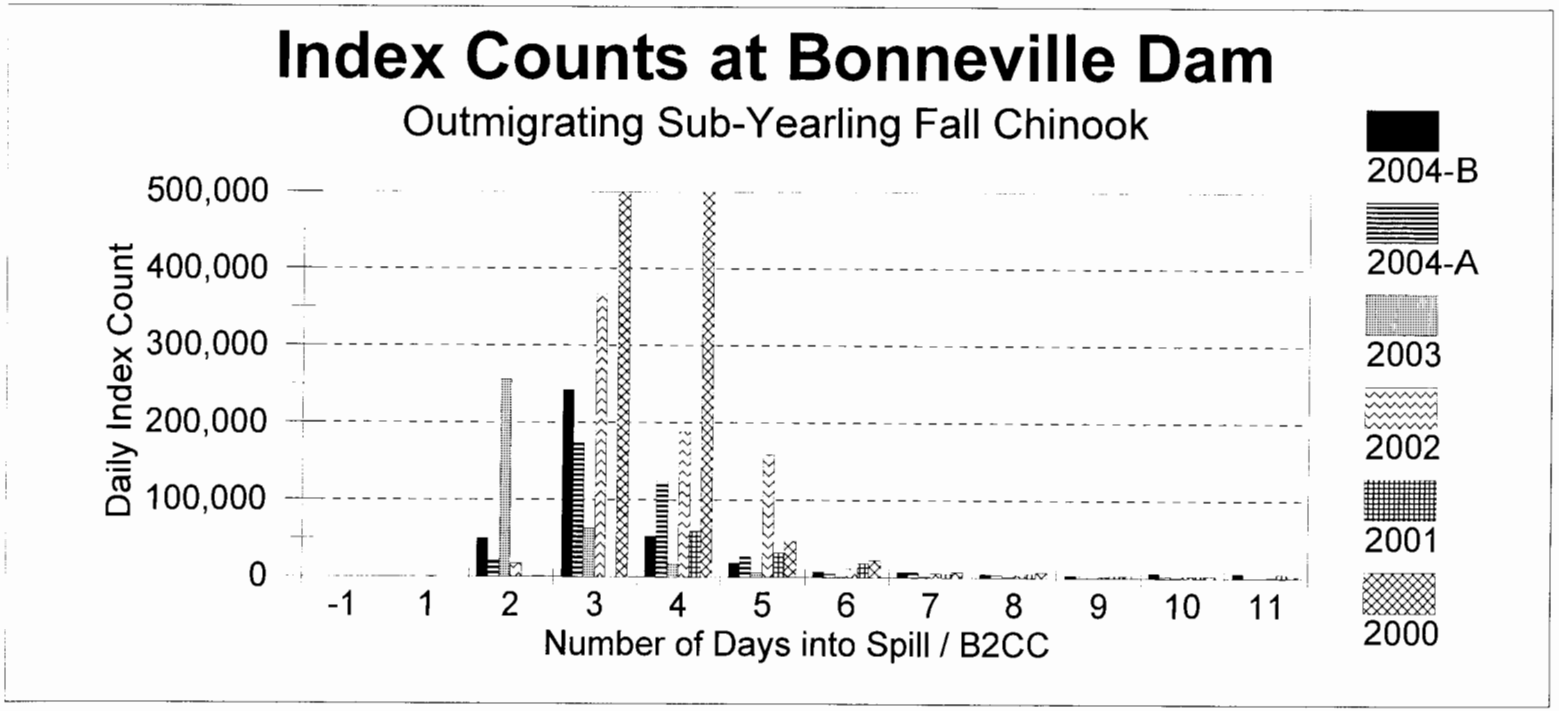

Figure 2. Fish passage index counts before and during spill periods at Bonneville Dam from 2000-2004.

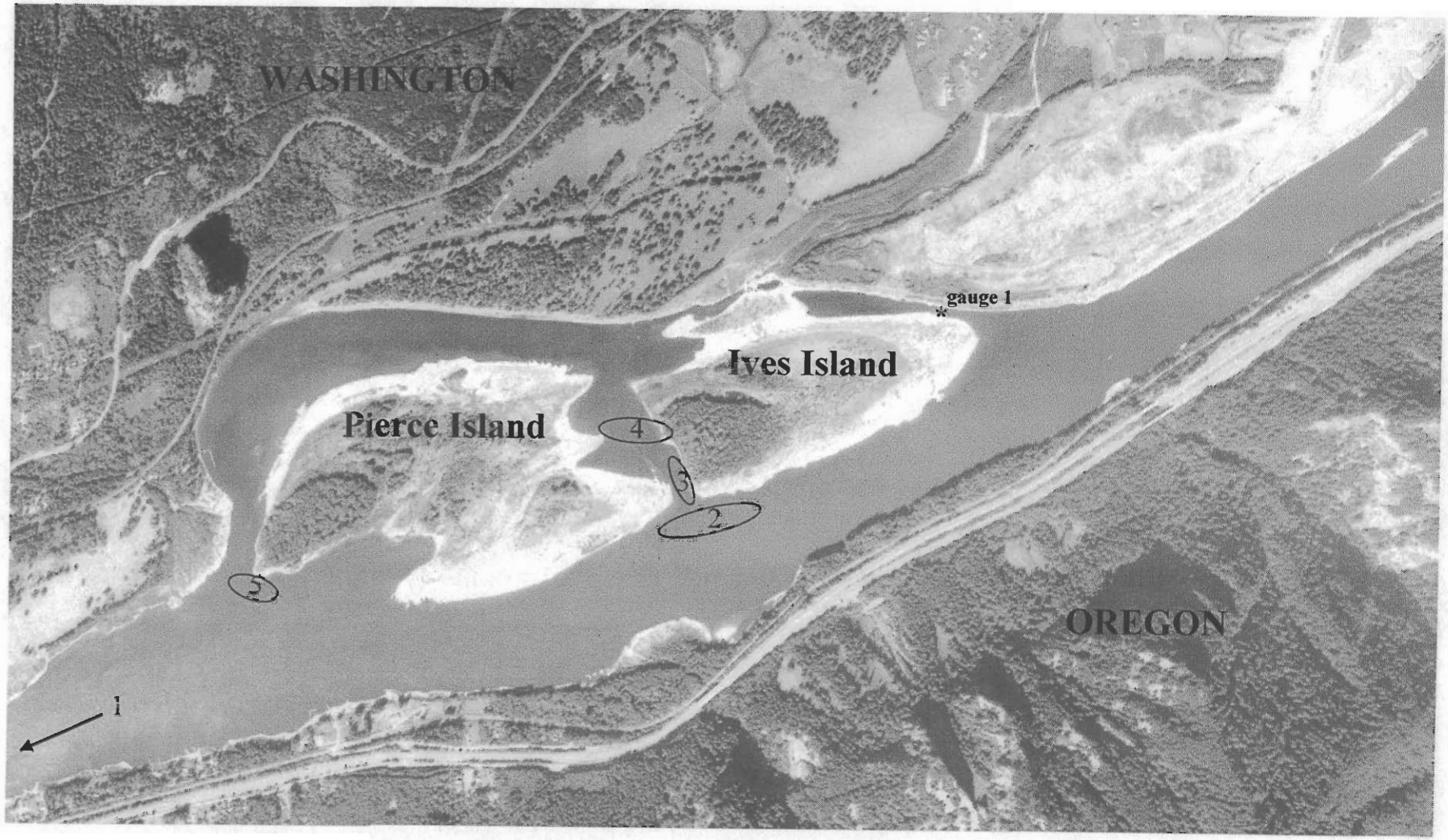

Figure 3. Location of WDFW/ODFW juvenile sampling sites (numbered) below Bonneville Dam, March 2004.

Table 2. Summary of fish sampled for signs of gas bubble trauma (GBT) below Bonneville Dam - March 2004. One hundred tweleve fish were examined. There were no signs of GBT.

Species	# of fish examined for signs of GBT	Mean (mm) Fork Length	Range (mm)	# of fish with observed bubble in structure DF*	AF*	CA*	EY*
Chum	10	40.2	38-45	0	0	0	0
Coho	1	38	38	0	0	0	0
Chinook	98	62.5	36-120	0	0	0	0
Killifish	2	31	30-32	0	0	0	0
Stickleback	1	47	47	0	0	0	0
Totals	112			0	0	0	0

* DF = dorsal fin, AF = anal fin, CA = caudal fin, EY = eye

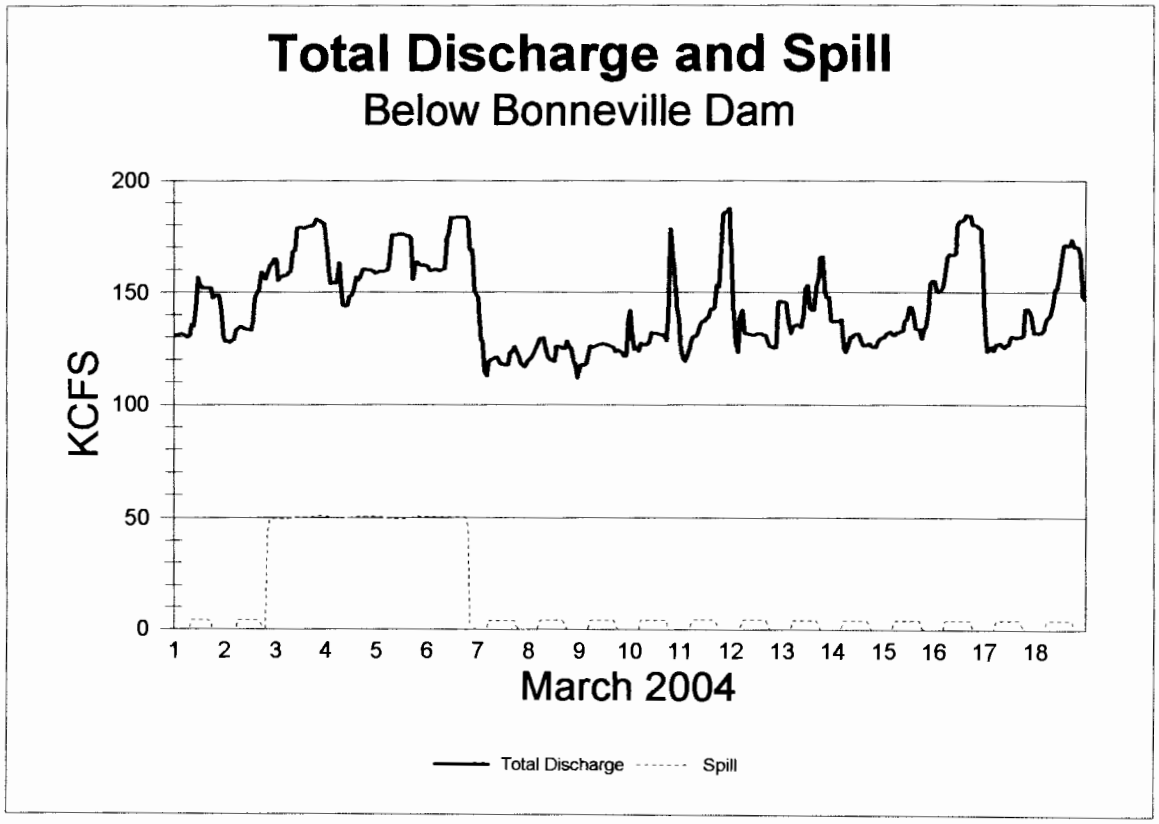

Figure 4. Total discharge and spill from Bonneville Dam - March 1-18, 2004.

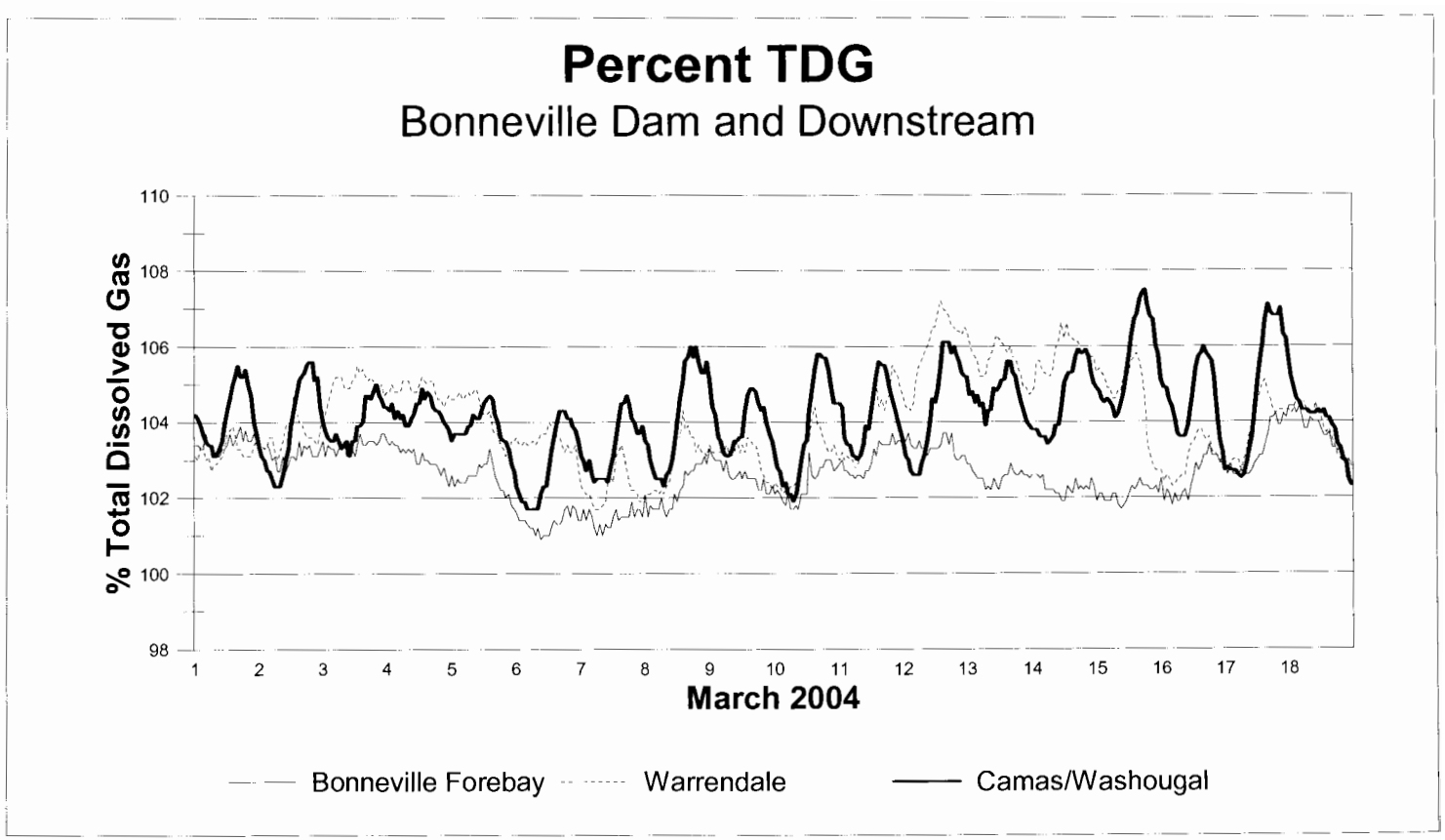

Figure 5. Percent TDG at Bonneville Dam Forebay, Warrendale, and Camas/Washougal monitoring sites, March 1-18, 2004.

Table 3. Total dissolved gas (TDG) in the Bonneville Dam tailrace and at Camas/Washougal, and relative TDG at depth of chum redds on the Oregon shore, March 2-6 (spill operation) and March 11-15 (corner collector operation), 2004.

Date	Daily	Spill (kcfs)	Total Flow (kcfs)	Tailwater (feet)	Depth (ft) above redds	Bonneville Dam Tailrace % TDG	Relative % TDG at Depth	% TDG Camas/ Washougal
02-Mar	Average	9.9	142.3	13.0	1.7	103.8	98.8	103.9
02-Mar	Minimum	0.0	127.6	12.4	1.1	103.0	95.1	102.3
02-Mar	Maximum	49.8	164.8	14.1	2.8	104.7	101.1	105.6
03-Mar	Average	50.1	171.9	13.8	2.5	105.1	97.5	104.0
03-Mar	Minimum	49.2	155.2	12.7	1.4	104.7	94.8	103.1
03-Mar	Maximum	50.7	182.7	14.6	3.3	105.5	101.0	105.0
04-Mar	Average	50.3	155.3	13.0	1.7	104.8	99.6	104.3
04-Mar	Minimum	49.8	143.9	12.5	1.2	104.4	97.0	103.8
04-Mar	Maximum	50.7	170.1	13.9	2.6	105.2	101.6	104.9
05-Mar	Average	50.0	166.9	13.9	2.6	104.0	96.2	103.9
05-Mar	Minimum	49.4	155.6	13.0	1.7	103.1	93.8	102.7
05-Mar	Maximum	50.7	176.1	14.5	3.2	104.9	99.7	104.7
06-Mar	Average	42.0	169.9	14.3	3.0	103.3	94.4	102.9
06-Mar	Minimum	0.0	149.2	13.4	2.1	102.1	90.9	101.7
06-Mar	Maximum	50.6	183.7	15.2	3.9	104.0	97.2	104.3
11-Mar	Average	2.2	144.4	13.1	1.8	104.2	98.7	104.2
11-Mar	Minimum	0.0	119.2	12.0	0.7	102.8	92.1	103.0
11-Mar	Maximum	4.3	187.5	15.4	4.1	105.5	101.6	105.6
12-Mar	Average	2.2	133.2	12.8	1.5	106.2	101.5	104.4
12-Mar	Minimum	0.0	123.2	12.1	0.8	104.3	95.6	102.6
12-Mar	Maximum	4.3	160.1	14.2	2.9	107.2	104.0	106.1
13-Mar	Average	2.2	144.8	13.1	1.8	105.5	100.0	104.7
13-Mar	Minimum	0.0	131.6	12.2	0.9	104.7	95.9	103.9
13-Mar	Maximum	4.2	166.0	14.3	3.0	106.3	103.5	105.6
14-Mar	Average	2.2	129.7	12.3	1.0	105.8	102.9	104.6
14-Mar	Minimum	0.0	123.2	12.0	0.7	105.2	100.7	103.4
14-Mar	Maximum	4.2	137.7	12.8	1.5	106.6	104.2	105.9
15-Mar	Average	2.2	136.2	12.4	1.1	104.3	101.0	105.6
15-Mar	Minimum	0.0	129.4	12.0	0.7	102.4	96.1	104.1
15-Mar	Maximum	4.0	155.0	13.4	2.1	105.8	103.2	107.5